# Differential Equations

Question 1.

If $(x + 2y^3)\dfrac{dy}{dx} = y$, then

(a) $\dfrac{x}{y} + y^2 = c$

(b) $\dfrac{y}{x} + x^2 = c$

(c) $\dfrac{x}{y} - y^2 = c$

(d) $\dfrac{y}{x} - x^2 = c$

Answer:

(c) $\frac{x}{y} - y^2 = c$

Question 2.

The solution of $\dfrac{dy}{dx} + \dfrac{y}{x} = \dfrac{1}{\sqrt{1+x^2}}$ is

(a) $y = \dfrac{1+x^2}{x} + \dfrac{c}{x}$

(b) $y = \dfrac{\sqrt{1+x^2}}{x} + \dfrac{c}{x}$

(c) $y = \dfrac{x}{\sqrt{1+x^2}} + cx$

(d) none of these

Answer:

(b) $y = \frac{\sqrt{1+x^2}}{x} + \frac{c}{x}$

Question 3.

**The solution of differential equation** $\dfrac{dy}{dx} - 3y = \sin 2x$ **is**

(a) $y = e^{-3x}\left[\dfrac{\cos 2x + 3\sin 2x}{13}\right] + c$

(b) $y = e^{-3x}\left(\dfrac{\cos 2x - 3\sin 2x}{13}\right) + c$

(c) $ye^{-3x} = -e^{-3x}\dfrac{(2\cos 2x + 3\sin 2x)}{13} + c$

(d) none of these

Answer:

(c) $ye^{-3x} = -e^{-3x}\frac{(2\cos 2x + 3\sin 2x)}{13} + c$

Question 4.
The solution of the differential equation,

$x^2 \dfrac{dy}{dx}\cdot\cos\dfrac{1}{x} - y\sin\dfrac{1}{x} = -1$, **where** $y \to -1$ **as** $x \to \infty$, **is**

(a) $y = \sin\dfrac{1}{x} - \cos\dfrac{1}{x}$

(b) $y = \dfrac{x+1}{x\sin\dfrac{1}{x}}$

(c) $y = \cos\dfrac{1}{x} + \sin\dfrac{1}{x}$

(d) $y = \dfrac{x+1}{x\cos\dfrac{1}{x}}$

Answer:
(a) $y = \sin\frac{1}{x} - \cos\frac{1}{x}$

Question 5.
The degree of the differential equation

$\left(\dfrac{d^2y}{dx^2}\right)^2 + \left(\dfrac{dy}{dx}\right)^2 = x\sin\left(\dfrac{dy}{dx}\right)$ **is**

(a) 1
(b) 2
(c) 3
(d) not defined

Answer:
(d) not defined

Question 6.

The order and degree of the differential equation $\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^{\frac{1}{4}} + x^{\frac{1}{5}} = 0$ respectively are

(a) 2 and not defined
(b) 2 and 2
(c) 2 and 3
(d) 3 and 3
Answer:
(a) 2 and not defined

Question 7.
Integrating factor of the differential equation

$(1 - x^2)\frac{dy}{dx} - xy = 1$ is

(a) $-x$    (b) $\frac{x}{1 + x^2}$    (c) $\sqrt{1 - x^2}$    (d) $\frac{1}{2}\log(1 - x^2)$

Answer:
(c) $\sqrt{1 - x^2}$

Question 8.
Integrating factor of the differential equation $\frac{dy}{dx} + y\tan x - \sec x = 0$ is

(a) cos x
(b) sec x
(c) $e^{\cos x}$
(d) $e^{\sec x}$
Answer:
(b) sec x

Question 9.
If $(x + y)^2 \frac{dy}{dx} = a^2$, y = 0 when x = 0, then y = a if $\frac{x}{a} =$

(a) 1
(b) tan 1
(c) tan 1 + 1
(d) tan 1 − 1
Answer:
(d) tan 1 − 1

Question 10.

If $\dfrac{dy}{dx} = \sin(x+y) + \cos(x+y), y(0) = 0$,     then

$\tan\dfrac{x+y}{2} =$

(a) $e^x - 1$     (b) $\dfrac{e^x - 1}{2}$     (c) $2(e^x - 1)$     (d) $1 - e^x$

Answer:
(a) $e^x - 1$

Question 11.
If $\sin x \dfrac{dy}{dx} + y \cos x = x \sin x$, then $(y - 1)\sin x =$
(a) $c - x \sin x$
(b) $c + x\cos x$
(c) $c - x \cos x$
(d) $c + x \sin x$
Answer:
(c) $c - x \cos x$

Question 12.
The solution of differential equation $(e^y + 1) \cos x\, dx + e^y \sin x\, dy = 0$ is
(a) $(e^y + 1) \sin x = c$
(b) $e^x \sin x = c$
(c) $(e^x + 1) \cos x = c$
(d) none of these
Answer:
(a) $(e^y + 1) \sin x = c$

Question 13.
The solution of the differential equation $\dfrac{dy}{dx} = \dfrac{x}{1+x^2}$ is

(a) $y = \dfrac{1}{2}\log|2 + x^2| + c$     (b) $y = \dfrac{1}{2}\log(1 + x) + c$

(c) $y = \log\left(\sqrt{1 + x^2}\right) + c$     (d) none of these

Answer:
(c) $y = \log(\sqrt{1 + x^2}) + c$

Question 14.

If $\dfrac{dy}{dx} = e^{-2y}$ and $y = 0$, when $x = 5$, then the value of $x$

when $y = 3$ is

(a) $e^5$  (b) $e^6 + 1$  (c) $\dfrac{e^6 + 9}{2}$  (d) $\log_e 6$

Answer:

(c) $\dfrac{e^6 + 9}{2}$

Question 15.

If $\dfrac{dy}{dx} = y \sin 2x$, $y(0) = 1$ then solution is

(a) $y = e \sin^2 x$  (b) $y = \sin^2 x$

(c) $y = \cos^2 x$  (d) $y = e^{\cos^2 x}$

Answer:

(a) $y = e \sin^2 x$

Question 16.

The differential equation of all 'Simple Harmonic Motions' of given period $\dfrac{2\pi}{n}$ is

(a) $\dfrac{d^2x}{dt^2} + nx = 0$  (b) $\dfrac{d^2x}{dt^2} + n^2 x = 0$

(c) $\dfrac{d^2x}{dt^2} - n^2 x = 0$  (d) $\dfrac{d^2x}{dt^2} + \dfrac{1}{n^2} x = 0$

Answer:

(b) $\dfrac{d^2x}{dt^2} + n^2 x = 0$

Question 17.

The differential equation of all parabolas whose axes are parallel to y-axis is

(a) $\dfrac{dy}{dx} = -\dfrac{c^2}{x^2}$  (b) $\dfrac{d^2x}{dy^2} = c$

(c) $\dfrac{d^3y}{dx^3} + \dfrac{d^2x}{dy^2} = 0$  (d) $\dfrac{d^2y}{dx^2} + 2\dfrac{dy}{dx} = c$

Answer:

(a) $\frac{dy}{dx} = -\frac{c^2}{x^2}$

Question 18.

The Solution of $\cos(x + y)\, dy = dx$ is

(a) $y = \tan\left(\dfrac{x+y}{2}\right) + C$

(b) $y = \cos^{-1}\left(\dfrac{y}{x}\right) + C$

(c) $y = x\sec\left(\dfrac{y}{x}\right) + C$

(d) none of these

Answer:

(a) $y = \tan\left(\frac{x+y}{2}\right) + C$

Question 19.

If $\dfrac{dy}{dx} = \dfrac{x+y}{x}$, $y(1) = 1$, then $y =$

(a) $x + \ln x$

(b) $x^2 + x \ln x$

(c) $xe^{x-1}$

(d) $x + x \ln x$

Answer:

(d) x + x ln x

Question 20.

If $(x^2 + y^2)dy = xy\, dx$, $y(1) = 1$, and $y(x_0) = e$, then $x_0 =$

(a) $\sqrt{2(e^2 - 1)}$

(b) $\sqrt{2(e^2 + 1)}$

(c) $\sqrt{3}.e$

(d) $\sqrt{\dfrac{e^2 + 1}{2}}$

Answer:

(c) √3e

## Question 21.

If $\dfrac{dy}{dx} = \dfrac{y}{x} + \tan\dfrac{y}{x}$, $y(1) = \dfrac{\pi}{2}$, then $y\left(\dfrac{1}{2}\right) =$

(a) $\dfrac{\pi}{3}$      (b) $\dfrac{\pi}{4}$      (c) $\dfrac{\pi}{6}$      (d) $\dfrac{\pi}{12}$

Answer:

(d) $\dfrac{\pi}{12}$

## Question 22.

If $\dfrac{dy}{dx} = \dfrac{y}{x}\left(\dfrac{x\cos\dfrac{y}{x} + y\sin\dfrac{y}{x}}{y\sin\dfrac{y}{x} - x\cos\dfrac{y}{x}}\right)$, then

(a) $x\cos\dfrac{y}{x} = cy$      (b) $x\sec\dfrac{y}{x} = cy$

(c) $\cos\dfrac{y}{x} = cxy$      (d) $\sec\dfrac{y}{x} = cxy$

Answer:

(d) $\sec\dfrac{y}{x} = cxy$

## Question 23.

If $\dfrac{dy}{dx} = \dfrac{y}{x - \sqrt{xy}}$, then

(a) $\sqrt{\dfrac{x}{y}} = \ln cy$      (b) $-\sqrt{\dfrac{x}{y}} = \ln cy$

(c) $-2\sqrt{\dfrac{x}{y}} = \ln cy$      (d) $2\sqrt{\dfrac{x}{y}} = \ln cy$

Answer:

(c) $-2\sqrt{\dfrac{x}{y}} = \ln cy$

Question 24.

If $(1+e^{x/y})dx + \left(1-\dfrac{x}{y}\right)e^{x/y}dy = 0$, then

(a) $x - ye^{x/y} = c$

(b) $y - xe^{x/y} = c$

(c) $x + ye^{x/y} = c$

(d) $y + xe^{x/y} = c$

Answer:

(c) $x + ye^{x/y} = c$

Question 25.

The solution curve of $\dfrac{dy}{dx} = \dfrac{y^2 - 2xy - x^2}{y^2 + 2xy - x^2}$, $y(-1) = 1$ is

(a) a straight line

(b) parabola

(c) circle

(d) ellipse

Answer:

(c) Circle

Question 26.
The differential equation of all circles which pass through the origin and whose centre lies on y-axis is

(a) $(x^2 - y^2)\dfrac{dy}{dx} - 2xy = 0$

(b) $(x^2 - y^2)\dfrac{dy}{dx} + 2xy = 0$

(c) $(x^2 - y^2)\dfrac{dy}{dx} - xy = 0$

(d) $(x^2 - y^2)\dfrac{dy}{dx} + xy = 0$

Answer:

(a) $(x^2 - y^2)\dfrac{dy}{dx} - 2xy = 0$

Question 27.
The differential equation of the family of circles touching the x-axis at origin is given by

(a) $y'' = \dfrac{1}{x^2 - y^2}y'$

(b) $y' = \dfrac{2xy}{x^2 - y^2}$

(c) $y'' - y' = \dfrac{xy}{x^2 - y^2}$

(d) none of these

Answer:

(b) $y' = \frac{2xy}{x^2 - y^2}$

Question 28.
The differential equation representing the family of ellipses with centre at origin and foci on x-axis is given as
(a) xy' + y = 0
(b) $x^2y^2(y'')^2 + yy' = 0$
(c) xyy" + x(y')$^2$ – yy' = 0
(d) None of these
Answer:
(b) $x^2y^2(y'')^2 + yy' = 0$

Question 29.
The differential equation of all parabolas whose axes are along x-axis is
(a) $y_2^2 + y_1 = 0$
(b) $y_1^2 + y_2 = 0$
(c) $y_1^2 + y_1 y_2 = 0$
(d) $y_1^2 + yy_2 = 0$
Answer:
(d) $y_1^2 + yy_2 = 0$

Question 30.
The equation of family of curves for which the length of the normal is equal to the radius vector is
(a) $y^2 \mp x^2 = k^2$
(b) $y \pm x = k$
(c) y$^2$ = kx
(d) none of these
Answer:
(a) $y^2 \mp x^2 = k^2$

Question 31.
Given the differential equation $\frac{dy}{dx} = \frac{6x^2}{2y + \cos y}$ ; y(1) = π
Mark out the correct statement.
(a) solution is y$^2$ – sin y = -2x$^3$ + C
(b) solution is y$^2$ + sin y = 2x$^3$ + C
(c) C = π$^2$+ 2√2
(d) C = π$^2$ + 2

Answer:
(b) solution is $y^2 + \sin y = 2x^3 + C$

Question 32.
The differential equation of all parabolas whose axis of symmetry is along the axis of the x-axis is of order
(a) 3
(b) 1
(c) 2
(d) none of these
Answer:
(c) 2

Question 33.
The degree of the equation satisfying the relation
$\sqrt{1+x^2} + \sqrt{1+y^2} = \lambda(\sqrt{1+y^2} - y\sqrt{1+x^2})$ is
(a) 1
(b) 2
(c) 3
(d) none of these
Answer:
(a) 1

Question 34.

The degree of the differential equation $\left(\frac{d^2y}{dx^2}\right)^{2/3} + 4 - \frac{3dy}{dx} = 0$ is

(a) 2
(b) 1
(c) 3
(d) none of these
Answer:
(a) 2

Question 35.
The differential equation whose solution is $(x-h)^2 + (y-k)^2 = a^2$ is (a is a constant)

(a) $\left[1+\left(\dfrac{dy}{dx}\right)^2\right]^3 = a^2\,\dfrac{d^2y}{dx^2}$

(b) $\left[1+\left(\dfrac{dy}{dx}\right)^2\right]^3 = a^2\left(\dfrac{d^2y}{dx^2}\right)^2$

(c) $\left[1+\left(\dfrac{dy}{dx}\right)\right]^3 = a^2\left(\dfrac{d^2y}{dx^2}\right)^2$

(d) none of these

Answer:

(b) $\left[1+\left(\dfrac{dy}{dx}\right)^2\right]^3 = a^2\left(\dfrac{d^2y}{dx^2}\right)^2$

Question 36.
The differential equation satisfied by $y = \dfrac{A}{x} + B$ is (A, B are parameters)

(a) $x^2\,y_1 = y$
(b) $xy_1 + 2y_2 = 0$
(c) $xy_2 + 2y_1 = 0$
(d) none of these

Answer:
(c) $xy_2 + 2y_1 = 0$

Question 37.
The solution of a differential equation is $y = c_1e^{4x} + c_2e^{3x}$, the differential equation is given by

(a) $\dfrac{d^2y}{dx^1} - 7\dfrac{dy}{dx} + 7 = 0$ 　　(b) $\dfrac{d^2y}{dx^2} + 7\dfrac{dy}{dx} - 12y = 0$

(c) $\dfrac{d^2y}{dx^2} - 7\dfrac{dy}{dx} + 12y = 0$ 　(d) none of these

Answer:
(c) $\dfrac{d^2y}{dx^2} - 7\dfrac{dy}{dx} + 12y = 0$

Question 38.
The differential equation satisfied by

$$\sqrt{1+x^2} + \sqrt{1+y^2}$$

$$= \lambda(x\sqrt{1+y^2} - y\sqrt{1+x^2}), \lambda \in R \text{ is}$$

(a) $\dfrac{dy}{dx} = \dfrac{1+x^2}{1+y^2}$

(b) $\dfrac{dy}{dx} = \dfrac{1+y^2}{1+x^2}$

(c) $\dfrac{dy}{dx} = (1+x^2)(1+y^2)$

(d) none of these

Answer:
(b) $\dfrac{dy}{dx} = \dfrac{1+y^2}{1+x^2}$

Question 39.
The solution of the differential equation $\dfrac{dy}{dx} = \dfrac{1+y^2}{1+x^2}$ is

(a) $y = \tan^{-1} x$
(b) $y - x = k(1 + xy)$
(c) $x = \tan^{-1} y$
(d) $\tan(xy) = k$
Answer:
(b) $y - x = k(1 + xy)$

Question 40.
The solution of the differential equation cos x sin y dx + sin x cos y dy = 0 is
(a) $\dfrac{\sin x}{\sin y} = c$
(b) sin x sin y = c
(c) sin x + sin y = c
(d) cos x cos y = c
Answer:
(b) sin x sin y = c

Question 41.
Which of the following is the general solution of

$$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = 0 \ ?$$

(a) $y = (Ax + B)e^x$

(b) $y = (Ax + B)e^{-x}$

(c) $y = Ae^x + Be^{-x}$

(d) $y = A\cos x + B\sin x$

Answer:

(a) $y = (Ax + B)\, e^x$

## Question 42.

General solution of $\dfrac{dy}{dx} + \dfrac{2xy}{1+x^2} = \dfrac{1}{(1+x^2)^2}$ is

(a) $y(1 + x^2) = c + \tan^{-1} x$ (b) $\dfrac{y}{1+x^2} = c + \tan^{-1} x$

(c) $y \log(1 + x^2) = c + \tan^{-1} x$

(d) $y(1 + x^2) = c + \sin^{-1} x$

Answer:

(a) $y(1 + x^2) = c + \tan^{-1} x$

## Question 43.

If $\dfrac{xdy}{dx} - y = \sqrt{x^2 + y^2}$, then

(a) $x + \sqrt{x^2 + y^2} = cy^2$

(b) $\sqrt{x^2 + y^2} - y = cx^2$

(c) $\sqrt{x^2 + y^2} + y = cx^2$

(d) $\sqrt{x^2 + y^2} - x = cy^2$

Answer:

(c) $\sqrt{x^2 + y^2} + y = cx^2$

## Question 44.

The solution of the differential equation $(x^2 + y^2)\, dx - 2xy\, dy = 0$ is

(a) $\dfrac{y}{x^2 + y^2} = c$         (b) $\dfrac{x^2 + y^2}{x} = c$

(c) $\dfrac{y^2 - x^2}{y} = c$         (d) $\dfrac{x^2 - y^2}{x} = c$

Answer:

(d) $\dfrac{x^2 - y^2}{x} = c$

Question 45.

The solution of the differential equation x dy + (x + y) dx = 0 is

(a) $c = \dfrac{y^2}{2} + xy$         (b) $c = xy + \dfrac{x^2}{2}$

(c) $c = x + \dfrac{(xy)^2}{2}$         (d) none of these

Answer:

(b) $c = xy + \dfrac{x^2}{2}$

Question 46.

The solution of differential equation $\dfrac{dy}{dx} = \dfrac{x-y}{x+y}$ is

(a) $x^2 - y^2 + 2xy + c = 0$
(b) $x^2 - y^2 - xy + c = 0$
(c) $x^2 - y^2 + xy + c = 0$
(d) $x^2 - y^2 - 2xy + c = 0$
Answer:

(d) $x^2 - y^2 - 2xy + c = 0$

Question 47.

The particular solution $In(\dfrac{dy}{dx}) = 3x + 4y$, y(0) = 0 is

(a) $e^{3x} + 3e^{-4y} = 4$
(b) $4e^{3x} - 3e^{-4y} = 3$
(c) $3e^{3x} + 4e^{4y} = 7$
(d) $4e^{3x} + 3e^{-4y} = 7$
Answer:

(d) $4e^{3x} + 3e^{-4y} = 7$

Question 48.
The solution of the differential equation

$$\frac{x}{x^2+y^2}dy = \left(\frac{y}{x^2+y^2}-1\right)dx \text{ , is}$$

(a) $y = x\cot(C-x)$

(b) $\cos^{-1}\frac{y}{x} = (-x+C)$

(c) $y = x\tan(C-x)$

(d) $\frac{y^2}{x^2} = x\tan(C-x)$

Answer:
(c) y = x tan(C – x)

Question 49.
The solution of the differential equation

$$\left(\frac{x+y-1}{x+y-2}\right)\frac{dy}{dx} = \left(\frac{x+y+1}{x+y+2}\right), \text{ when } x=1, y=1, \text{ is}$$

(a) $\log\left|\frac{(x-y)^2-2}{2}\right| = 2(x+y)$

(b) $\log\left|\frac{(x-y)^2+2}{2}\right| = 2(x-y)$

(c) $\log\left|\frac{(x+y)^2+2}{2}\right| = 2(x-y)$

(d) none of these

Answer:
(d) None of these

Question 50.
The solution of the differential equation

$$xdx + ydy + \frac{xdy - ydx}{x^2 + y^2} = 0 \text{ , is}$$

(a) $y = x \tan\left(\dfrac{x^2 + y^2 + C}{2}\right)$

(b) $x = y \tan\left(\dfrac{x^2 + y^2 + C}{2}\right)$

(c) $y = x \tan\left(\dfrac{C - x^2 - y^2}{2}\right)$

(d) none of these

Answer:

(c) $y = x \tan\left(\dfrac{C - x^2 - y^2}{2}\right)$

Question 51.

If $\dfrac{dy}{dx} = \dfrac{2}{x + y}$, then $x + y + 2 =$

(a) $ce^y$     (b) $ce^{y/2}$     (c) $ce^{-y}$     (d) $ce^{-\frac{y}{2}}$

Answer:
(b) $ce^{y/2}$

Question 52.

The differential equation $\dfrac{dy}{dx} = \sqrt{\dfrac{1-y^2}{y}}$ determines a family of circle with
(a) variable radii and fixed centre (0, 1)
(b) variable radii and fixed centre (0, -1)
(c) fixed radius 1 and variable centre on x-axis
(d) fixed radius 1 and variable centre on y-axis
Answer:
(c) fixed radius 1 and variable centre on x-axis

Question 53.
If y dx + y² dy = x dy, x ∈ R, y > 0 and y(1) = 1, then y(-3) =
(a) 3

(b) 2
(c) 1
(d) 5
Answer:
(a) 3

Question 54.
The solution of $y\,dx + (x + x^2y)\,dy = 0$ is

(a) $-\dfrac{1}{xy} = c$

(b) $-\dfrac{1}{xy} + \ln y = c$

(c) $\dfrac{1}{xy} + \ln y = c$

(d) $\ln y = cx$

Answer:
(b) $-\dfrac{1}{xy} + \ln y = c$

Question 55.
If $\dfrac{x\,dy}{dx} + 2y = \ln x$, then $e^2 y(e) - y(1) =$

(a) $\dfrac{e^2 + 1}{2}$

(b) $\dfrac{e^2 + 1}{3}$

(c) $\dfrac{e^2 + 1}{4}$

(d) $e^2 + 1$

Answer:
(c) $\dfrac{e^2+1}{4}$

Question 56.
If $x(x - 1)\dfrac{dy}{dx} - y = x^2(x - 1)^2$, then $4y(2) - y(1) =$

(a) 0      (b) 2      (c) 4      (d) 6

Answer:
(d) 6

Question 57.
If $x\ln x\dfrac{dy}{dx} + y = 2\ln x$, $y(e) = 2$, then $y(e^2) =$

(a) 1      (b) $\dfrac{3}{2}$      (c) 2      (d) $\dfrac{5}{2}$

Answer:

(d) $\frac{5}{2}$

Question 58.

If $(1+x^2)\dfrac{dy}{dx} + y = \tan^{-1} x, y(0) = 1$, then $y\left(\dfrac{\pi}{4}\right) =$

(a) $\dfrac{1}{e}$      (b) $e$      (c) $2e$      (d) $\dfrac{2}{e}$

Answer:

(d) $\frac{2}{e}$